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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/446,711 04/03/00 ALLARD

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EXAMINER

HM22/0925

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ART UNIT PAPER NUMBER

1638
DATE MAILED:

09/25/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/446,711

Applicant(s)

ALLARD ET AL.

Examiner

Cynthia Collins

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 April 2000 and 12 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) 23,26-35 and 37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22,24,25 and 36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-22, 24-25, and 36 in Paper No. 7 is acknowledged. The traversal is on the ground(s) that no separate search is required to search the non-elected groups as all claims are generally directed to the novel use of betaine in improving freezing tolerance of plants, and can be reviewed in a single search. This is not found persuasive because while the search of Group I may overlap with the search of Groups II-V, their searches are not coextensive of each other. In this particular instance, a search of Group I is not coextensive with a search of Groups II-V, since Group I requires a search for methods of plant cold acclimation, whereas Groups II-V require searches for methods involving reducing plant growth rate, methods involving stimulating and improving seed germination rate, methods involving plants sensitive to a temperature of about 0°C, and methods involving increasing the accumulation of a protein having the biological characteristics of WCOR410 respectively, said methods not being required to be searched for Group I. Claims 23, 26-35, and 37 are withdrawn from consideration as being directed to nonelected inventions.

2. The requirement is still deemed proper and is therefore made FINAL.

Priority

3. A foreign priority is claimed.

Drawings

4. The drawings are objected to by the Draftsperson as informal for the reasons indicated on Form PTO 948.

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5. The drawing of page 2 (Figure 2) is objected to because Figure 2A and Figure 2B are not properly labeled. Correction is required.

6. The drawings of pages 4 and 5 (Figures 4A, 4B, 5A, and 5B) are objected to under 37 CFR 1.83(a) because they fail to show the appearance of golf turf as described in the specification. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Correction is required.

7. Color photographs and color drawings are acceptable only for examination purposes unless a petition filed under 37 CFR 1.84(a)(2) or (b)(2) is granted permitting their use as formal drawings. In the event applicant wishes to use the drawings currently on file as formal drawings, a petition must be filed for acceptance of the photographs or color drawings as formal drawings. Any such petition must be accompanied by the appropriate fee as set forth in 37 CFR 1.17(i), three sets of drawings or photographs, as appropriate, and an amendment to the first paragraph of the brief description of the drawings section of the specification which states:

The file of this patent contains at least one drawing executed in color. Copies of this patent with color drawing(s) will be provided by the Patent and Trademark Office upon request and payment of the necessary fee.

Color photographs will be accepted if the conditions for accepting color drawings have been satisfied.

Specification

8. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it

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pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 4-6 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

11. The claims are drawn to a method of increasing or inducing cold or freezing tolerance in a plant by acclimating a plant, and by increasing the concentration of betaine or a derivative thereof in the plant, wherein the step of increasing the concentration of betaine or a derivative thereof in the plant includes overexpressing one or more genes involved in the synthesis of betaine or a derivative thereof.

12. However, the specification does not provide any definitive evidence that overexpressing any gene involved in the synthesis of betaine or a derivative thereof, alone or in combination with cold acclimation, will result in an increase in the concentration of betaine or a derivative thereof in a plant. The specification also does not provide any definitive evidence that overexpressing any gene involved in the synthesis of betaine or a derivative thereof, alone or in combination with cold acclimation, will result in an increase or induction of cold or freezing tolerance in a plant. The specification does not teach any examples of how to make or use plants that overexpress one or more genes involved in the synthesis of betaine or a derivative thereof.

13. Guidance for making and using the claimed invention is necessary for enablement because the ability of betaine synthesis transgenes to increase the concentration of betaine and thereby increase or induce cold or freezing tolerance in a plant is highly unpredictable.

14. Rathinasabapathi et al. teach transgenic tobacco plants that express spinach and beet betaine aldehyde dehydrogenase transgenes (Planta, 1994, Vol. 193, pages 155-162).

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Rathinasabapathi et al. teach that the expression of a betaine aldehyde dehydrogenase transgene as only a first step toward engineering betaine biosynthesis in tobacco, because tobacco also lacks the preceding biosynthetic enzyme choline monooxygenase (page 156, column 1, first full paragraph). Rathinasabapathi et al. also teach that they chose to first obtain plants expressing the betaine aldehyde dehydrogenase transgene because the betaine aldehyde product produced by choline monooxygenase is toxic to plants (*id.*). In addition, Rathinasabapathi et al. teach that transgenic tobacco plants expressing a betaine aldehyde dehydrogenase transgene require betaine aldehyde supplementation to accumulate significant amounts of betaine, and that the toxicity of betaine aldehyde complicates the interpretation of experiments designed to test whether the betaine so accumulated can afford tolerance to osmotic stress (page 161 column 1 last paragraph).

15. Nuccio et al. teach transgenic tobacco plants that express a spinach choline monooxygenase transgene (The Plant Journal, 1998, Vol. 16, No. 4, pages 487-496). Nuccio et al. teach that glycine betaine synthesis is limited in these plants due to the lack of available choline substrate required for the synthesis of glycine betaine (page 490 column 2 first full paragraph and Figure 5).

16. Because the ability of betaine synthesis transgenes to increase the concentration of betaine and thereby increase or induce cold or freezing tolerance in a plant has not been demonstrated, the claimed invention is not enabled by the specification in the absence of further guidance or example.

17. Claims 1-3, 7-22, 24-25, and 36 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a method of increasing or inducing cold or

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freezing tolerance in the wheat cultivar Glenlea, said method comprising simultaneously acclimating the plant and increasing the concentration of betaine in the plant by administering a betaine composition, wherein the lethal temperature of the plant is decreased, wherein the acclimation temperature is 6° C during the day and 2° C during the night, and wherein the betaine composition comprises betaine at 100 to 250 mM, does not reasonably provide enablement for other methods of increasing or inducing cold or freezing tolerance in other plants. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims.

18. The claims are drawn to a method of increasing or inducing cold or freezing tolerance in a plant by acclimating a plant by increasing the concentration of betaine or a derivative thereof in the plant, wherein the step of increasing the concentration of betaine or a derivative thereof in the plant includes administering a composition comprising betaine or a derivative thereof to a plant. The claims are also drawn to said method wherein the lethal temperature of the plant is decreased, said method wherein the acclimation temperature is higher than about 0° C, said method wherein the acclimation temperature is below about 6° C, said method wherein the acclimation and administration of betaine are substantially simultaneous, said method wherein the acclimation step follows the administration of betaine step, said method wherein the acclimation step precedes the administration of betaine step, said method wherein specific betaine derivative compounds are administered, said method applied to specific plant species, said method wherein the betaine composition comprises glycine betaine at less than 500 mM, less than 250 mM, and 250 mM, said method wherein winter survival, spring regrowth, greening

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or density of golf turf is increased, said method wherein photosynthetic capacity and overall physiology at cold temperature is improved, said method wherein tolerance to salinity and/or water stress is increased or induced, and said method wherein cold or freezing tolerance is optimal.

19. The specification teaches only a method of increasing or inducing cold or freezing tolerance in the wheat cultivar Glenlea, said method comprising simultaneously acclimating the plant and increasing the concentration of betaine in the plant by administering a betaine composition, wherein the lethal temperature of the plant is decreased, wherein the acclimation temperature is 6° C during the day and 2° C during the night, and wherein the betaine composition comprises betaine at 100 to 250 mM (Figures 1 and 2, page 4 line 10 to page 5 line 10, page 7 line 31 to page 8 line 22). The specification does not teach other acclimation temperatures, discontinuous administration of a betaine composition, the use of plants other than the wheat cultivar Glenlea, the use of any specific betaine or betaine derivative compound, the improvement of photosynthetic capacity or overall physiology at cold temperature, the increase or induction of tolerance to salinity and/or water stress, or optimal cold or freezing tolerance. Although the specification does suggest that betaine application improves winter survival and spring regrowth of golf turf (page 10 lines 17-20), the evidence offered in support of this assertion, namely Figures 4 and 5, cannot be evaluated due to the poor quality of photocopied photographs.

20. Guidance for making and using the claimed invention is necessary for enablement because the effect of betaine accumulation in plants is highly unpredictable.

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21. Gibon et al. (Plant, Cell, and Environment, 1997, Vol. 20, pages 329-340) teach that the number of plant species known to accumulate glycine betaine is restricted, and that glycine betaine may be a non-compatible solute in plants that do not accumulate it (page 329 column 1 lines 18-22 and page 337 column 2 first full paragraph).
22. Xing et al. (Environmental and Experimental Botany, 2001, Vol. 46, pages 21-28) teach that the maximum increase in freezing tolerance of *Arabidosis* leaves occurs upon application of 10 mM glycine betaine, and that application of higher glycine betaine concentrations cause damage to leaves (page 24, column 2, second paragraph). In contrast, the instant application teaches that concentrations of 100 and 250 mM betaine may be applied to the wheat cultivar Glenlea to increase freezing tolerance, and that betaine toxicity was observed upon application of 500 mM betaine (page 7 line 31 through page 8 line 7).
23. Because different plant species may respond differently to the application and accumulation of glycine betaine, the effect of betaine accumulation in plants is highly unpredictable.
24. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
25. Claims 4-8, 15, 18, 24, and 36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
26. Regarding claim 4, the phrase "genes involved in the synthesis of betaine or a derivative thereof" renders the claim indefinite because it is unclear which genes are encompassed by the claim.

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27. Regarding claims 4-6, the phrase "one or more" renders the claims indefinite because it is unclear how many genes are encompassed by the claims.

28. Regarding claim 7, the phrase "higher than about 0° C" renders the claim indefinite because it is unclear what temperature range is encompassed by the claim, and because it is unclear whether "said temperature" refers to the acclimation temperature, or to the coldest temperature that said plant is capable of withstanding.

29. Regarding claim 8, the phrase "below about 6° C" renders the claim indefinite because it is unclear what temperature range is encompassed by the claim, and because it is unclear whether "said temperature" refers to the acclimation temperature, or to the coldest temperature that said plant is capable of withstanding.

30. Regarding claim 15, the phrase "the group consisting of tropical plants, gramineae, and grasses" renders the claim indefinite because it is unclear what plants are encompassed by the group.

31. Claim 18 recites the limitation "composition" in claim 10 or 11. There is insufficient antecedent basis for this limitation in claim 10 or 11, or in claim 1 from which they depend.

32. Regarding claim 24, the phrases "overall physiology" and "at cold temperature" render the claim indefinite because it is unclear what constitutes "overall physiology", and because it is unclear what constitutes "cold temperature".

33. Regarding claim 36, "about an optimal cold or freezing tolerance" renders the claim indefinite because it is unclear what constitutes "an optimal cold or freezing tolerance".

Claim Rejections - 35 USC § 103

34. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

35. Claims 1-3, 7-22, 24-25, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rajashekar et al. (Plant Physiology, 1996, Vol. 111, No. 2 SUPPL., page 70) in view of Kishitani et al. (Plant, Cell, and Environment, 1994, Vol. 17, pages 89-95), and in light of Zhao et al. (Journal of Plant Physiology, 1992, Vol. 140, pages 541-543).

36. The claims are drawn to a method of increasing or inducing cold or freezing tolerance in a plant by acclimating a plant, and by increasing the concentration of betaine or a derivative thereof in the plant, wherein the step of increasing the concentration of betaine or a derivative thereof in the plant includes administering a composition comprising betaine or a derivative thereof to a plant.

37. Rajashekar et al. teach a method of increasing or inducing cold or freezing tolerance in strawberry plants by acclimating the plant, and by increasing the concentration of betaine in the plant, wherein the step of increasing the concentration of betaine the plant includes administering a composition comprising glycine betaine.

38. Rajashekar et al. do not teach a specific lethal temperature, a specific acclimation temperature, the timing of administration of betaine, the administration of compositions other than glycine betaine, the effect on plant species other than strawberry, or the use of glycine betaine concentrations other than 2 mM.

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39. Kishitani et al. teach the accumulation of glycine betaine during cold acclimation (page 91 Figure 1) and the correlation of glycine betaine levels and freezing tolerance in barley plants (page 93 Figure 4).

40. Zhao et al teach the ability of glycine betaine to act as a cryoprotectant when applied to alfalfa seedlings at a concentration of 200 mM (page 542 Figure 2).

41. Given the success of Rajashekar et al. in increasing or inducing cold or freezing tolerance in strawberry plants by acclimating the plants and by administering exogenous glycine betaine to the plants, and given the teaching of by Kishitani et al. and Zhao et al. that glycine betaine accumulates during cold acclimation, that glycine betaine levels correlate with freezing tolerance, and that exogenously applied glycine betaine can act as a cryoprotectant in plants, it would have been *prima facie* obvious to one skilled in the art at the time the invention was made to combine cold acclimation and the exogenous administration of betaine to a plant, for the purpose of increasing or inducing cold or freezing tolerance in a plant, without any surprising or unexpected results. In addition, specific lethal temperature and acclimation temperatures would be unique to the species and cultivars used, and thus would represent alterations of design parameters that would have been obvious to one of ordinary skill in the art at the time the invention was made. The timing of the administration of betaine, the administration of betaine compositions other than glycine betaine, and the concentration of betaine administered would also represent obvious alterations of design parameters.

42. Accordingly, one skilled in the art would have been motivated to generate the claimed invention with a reasonable expectation of success. Thus, the claimed invention would have been

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prima facie obvious as a whole to one of ordinary skill in the art at the time the invention was made, especially in the absence of evidence to the contrary.

43. Claims 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rajashekar et al. (Plant Physiology, 1996, Vol. 111, No. 2 SUPPL., page 70) in view of Virtanen et al. (WO 97/08951 13 March 1997), and in light of Kishitani et al. (Plant, Cell, and Environment, 1994, Vol. 17, pages 89-95).

44. The claims are drawn to a method of increasing or inducing cold or freezing tolerance in a plant by acclimating a plant, and by increasing the concentration of betaine or a derivative thereof in the plant, wherein the step of increasing the concentration of betaine or a derivative thereof includes administering a composition comprising betaine or a derivative thereof to a plant. The claims are also drawn to said method wherein photosynthetic capacity and overall physiology at cold temperature is improved, and wherein tolerance to salinity and/or water stress is increased or induced.

45. The teachings of Rajashekar et al. are discussed *supra*.

46. Rajashekar et al. do not teach the effect of their method on photosynthetic capacity and overall physiology at cold temperature, or the effect of their method on tolerance to salinity and/or water stress.

47. Virtanen et al. teach a method of increasing or inducing water stress tolerance and salt tolerance in legumes by increasing the concentration of betaine in the plant, wherein the step of increasing the concentration of betaine includes administering a composition comprising glycine betaine (page 14 Table 2, page 19 Tables 5 and 6, page 22 Table 7, page 23 Table 8, page 24 Table 9, and Figures 1 and 2). Virtanen et al. also teach a method of improving photosynthetic

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capacity in legumes by increasing the concentration of betaine in the plant, wherein the step of increasing the concentration of betaine includes administering a composition comprising glycine betaine (page 26 Table 10 and Figure 3).

48. The teachings of Kishitani et al. are discussed *supra*.

49. Given the success of Rajashekar et al. in increasing or inducing cold or freezing tolerance in strawberry plants by acclimating the plants and by administering exogenous glycine betaine to the plants, given the teaching of Kishitani et al. that glycine betaine accumulates during cold acclimation, and given the success of Virtanen et al. in increasing or inducing water stress tolerance and salt tolerance in legumes, and in improving photosynthetic capacity in legumes, by increasing the concentration of betaine in the plants, it would have been *prima facie* obvious to one skilled in the art at the time the invention was made to combine cold acclimation and the exogenous administration of betaine to a plant for the purpose of increasing or inducing tolerance to salinity and/or water stress, and for the purpose of improving photosynthetic capacity, without any surprising or unexpected results.

Remarks

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cynthia Collins whose telephone number is (703) 605-1210. The examiner can normally be reached on Monday-Friday 8:45 AM -5:15 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paula Hutzell can be reached on (703) 308-4310. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-4242 for regular communications and 1 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0196.

CC

September 20, 2001

50.

ELIZABETH F. McELWAIN
PRIMARY EXAMINER
GROUP 1600

E. F. McElwain